PART A

Preparing Dataset

```
================================================================================
PART A: Using SUBSET of training data
  Training images: 10000 (subset)
  Validation images: 5000 (full)
================================================================================

Preparing train set...
100%|██████████| 10000/10000 [00:03<00:00, 2581.73it/s]
Saved 10000 images and labels to /content/mnistdd_yolo/train
Preparing val set...
100%|██████████| 5000/5000 [00:01<00:00, 2671.93it/s]
Saved 5000 images and labels to /content/mnistdd_yolo/val

Dataset preparation complete!
Train images: 10000 files
Train labels: 10000 files
Val images: 5000 files
Val labels: 5000 files

Dataset configuration saved to /content/mnistdd_yolo/dataPartA.yaml
```

Training

```
Downloading https://github.com/ultralytics/assets/releases/download/v8.3.0/yolov8n.pt to 'yolov8n.pt':
100% ──────────────────── 6.2MB 328.0MB/s 0.0s

Starting training...
Ultralytics 8.3.221 🚀 Python-3.12.12 torch-2.8.0+cu126 CUDA:0 (Tesla T4, 15095MiB)
engine/trainer: agnostic_nms=False, amp=True, augment=False, auto_augment=randaugment, batch=32,
bgr=0.0, box=7.5, cache=False, cfg=None, classes=None, close_mosaic=10, cls=0.5, compile=False,
conf=None, copy_paste=0.0, copy_paste_mode=flip, cos_lr=False, cutmix=0.0,
data=/content/mnistdd_yolo/dataPartA.yaml, degrees=0.0, deterministic=True, device=0, dfl=1.5,
dnn=False, dropout=0.0, dynamic=False, embed=None, epochs=10, erasing=0.4, exist_ok=True, fliplr=0.5,
flipud=0.0, format=torchscript, fraction=1.0, freeze=None, half=False, hsv_h=0.015, hsv_s=0.7,
hsv_v=0.4, imgsz=64, int8=False, iou=0.7, keras=False, kobj=1.0, line_width=None, lr0=0.01, lrf=0.01,
mask_ratio=4, max_det=300, mixup=0.0, mode=train, model=yolov8n.pt, momentum=0.937, mosaic=1.0,
multi_scale=False, name=yolo_train, nbs=64, nms=False, opset=None, optimize=False, optimizer=auto,
overlap_mask=True, patience=10, perspective=0.0, plots=True, pose=12.0, pretrained=True, profile=False,
project=mnistdd_runs, rect=False, resume=False, retina_masks=False, save=True, save_conf=False,
save_crop=False, save_dir=/content/mnistdd_runs/yolo_train, save_frames=False, save_json=False,
save_period=-1, save_txt=False, scale=0.5, seed=0, shear=0.0, show=False, show_boxes=True,
show_conf=True, show_labels=True, simplify=True, single_cls=False, source=None, split=val,
stream_buffer=False, task=detect, time=None, tracker=botsort.yaml, translate=0.1, val=True,
verbose=True, vid_stride=1, visualize=False, warmup_bias_lr=0.1, warmup_epochs=3.0, warmup_momentum=0.8,
weight_decay=0.0005, workers=8, workspace=None
Downloading https://ultralytics.com/assets/Arial.ttf to '/root/.config/Ultralytics/Arial.ttf': 100%
──────────────────── 755.1KB 148.2MB/s 0.0s
Overriding model.yaml nc=80 with nc=10
```

```
                   from  n    params  module                                       arguments
  0                  -1  1       464  ultralytics.nn.modules.conv.Conv             [3, 16, 3, 2]
  1                  -1  1      4672  ultralytics.nn.modules.conv.Conv             [16, 32, 3, 2]
  2                  -1  1      7360  ultralytics.nn.modules.block.C2f             [32, 32, 1, True]
  3                  -1  1     18560  ultralytics.nn.modules.conv.Conv             [32, 64, 3, 2]
  4                  -1  2     49664  ultralytics.nn.modules.block.C2f             [64, 64, 2, True]
  5                  -1  1     73984  ultralytics.nn.modules.conv.Conv             [64, 128, 3, 2]
  6                  -1  2    197632  ultralytics.nn.modules.block.C2f             [128, 128, 2, True]
  7                  -1  1    295424  ultralytics.nn.modules.conv.Conv             [128, 256, 3, 2]
  8                  -1  1    460288  ultralytics.nn.modules.block.C2f             [256, 256, 1, True]
  9                  -1  1    164608  ultralytics.nn.modules.block.SPPF            [256, 256, 5]
 10                  -1  1         0  torch.nn.modules.upsampling.Upsample         [None, 2, 'nearest']
 11            [-1, 6]  1         0  ultralytics.nn.modules.conv.Concat           [1]
 12                  -1  1    148224  ultralytics.nn.modules.block.C2f             [384, 128, 1]
 13                  -1  1         0  torch.nn.modules.upsampling.Upsample         [None, 2, 'nearest']
 14            [-1, 4]  1         0  ultralytics.nn.modules.conv.Concat           [1]
 15                  -1  1     37248  ultralytics.nn.modules.block.C2f             [192, 64, 1]
 16                  -1  1     36992  ultralytics.nn.modules.conv.Conv             [64, 64, 3, 2]
 17           [-1, 12]  1         0  ultralytics.nn.modules.conv.Concat           [1]
 18                  -1  1    123648  ultralytics.nn.modules.block.C2f             [192, 128, 1]
 19                  -1  1    147712  ultralytics.nn.modules.conv.Conv             [128, 128, 3, 2]
 20            [-1, 9]  1         0  ultralytics.nn.modules.conv.Concat           [1]
 21                  -1  1    493056  ultralytics.nn.modules.block.C2f             [384, 256, 1]
 22        [15, 18, 21]  1    753262  ultralytics.nn.modules.head.Detect           [10, [64, 128, 256]]
Model summary: 129 layers, 3,012,798 parameters, 3,012,782 gradients, 8.2 GFLOPs

Transferred 319/355 items from pretrained weights
Freezing layer 'model.22.dfl.conv.weight'
AMP: running Automatic Mixed Precision (AMP) checks...
Downloading https://github.com/ultralytics/assets/releases/download/v8.3.0/yolo11n.pt to 'yolo11n.pt':
100% ━━━━━━━━━━━━━━━━━━━━ 5.4MB 270.1MB/s 0.0s
AMP: checks passed ✅
train: Fast image access ✅ (ping: 0.0±0.0 ms, read: 76.9±41.6 MB/s, size: 1.3 KB)
train: Scanning /content/mnistdd_yolo/train/labels... 10000 images, 0 backgrounds, 0 corrupt: 100%
━━━━━━━━━━━━━━━━━━━━ 10000/10000 2.4Kit/s 4.1s
train: New cache created: /content/mnistdd_yolo/train/labels.cache
albumentations: Blur(p=0.01, blur_limit=(3, 7)), MedianBlur(p=0.01, blur_limit=(3, 7)), ToGray(p=0.01,
method='weighted_average', num_output_channels=3), CLAHE(p=0.01, clip_limit=(1.0, 4.0),
tile_grid_size=(8, 8))
val: Fast image access ✅ (ping: 0.0±0.0 ms, read: 54.9±24.8 MB/s, size: 1.3 KB)
val: Scanning /content/mnistdd_yolo/val/labels... 5000 images, 0 backgrounds, 0 corrupt: 100%
━━━━━━━━━━━━━━━━━━━━ 5000/5000 1.9Kit/s 2.6s
val: New cache created: /content/mnistdd_yolo/val/labels.cache
Plotting labels to /content/mnistdd_runs/yolo_train/labels.jpg...
optimizer: 'optimizer=auto' found, ignoring 'lr0=0.01' and 'momentum=0.937' and determining best
'optimizer', 'lr0' and 'momentum' automatically...
optimizer: AdamW(lr=0.000714, momentum=0.9) with parameter groups 57 weight(decay=0.0), 64
weight(decay=0.0005), 63 bias(decay=0.0)
Image sizes 64 train, 64 val
Using 2 dataloader workers
Logging results to /content/mnistdd_runs/yolo_train
Starting training for 10 epochs...
Closing dataloader mosaic
albumentations: Blur(p=0.01, blur_limit=(3, 7)), MedianBlur(p=0.01, blur_limit=(3, 7)), ToGray(p=0.01,
method='weighted_average', num_output_channels=3), CLAHE(p=0.01, clip_limit=(1.0, 4.0),
tile_grid_size=(8, 8))

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
       1/10     0.158G      1.747       3.13      1.003         32         64: 100%
```

```
──────────────────── 313/313 8.1it/s 38.8s
                Class     Images  Instances      Box(P          R      mAP50  mAP50-95): 100%
──────────────────── 79/79 4.3it/s 18.6s
                  all       5000      10000      0.495      0.536      0.505      0.226

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
       2/10     0.186G      1.246      1.254     0.8792         32         64: 100%
──────────────────── 313/313 9.3it/s 33.8s
                Class     Images  Instances      Box(P          R      mAP50  mAP50-95): 100%
──────────────────── 79/79 4.0it/s 19.6s
                  all       5000      10000      0.568      0.619      0.606      0.254

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
       3/10     0.203G      1.145     0.9818     0.8654         32         64: 100%
──────────────────── 313/313 9.1it/s 34.5s
                Class     Images  Instances      Box(P          R      mAP50  mAP50-95): 100%
──────────────────── 79/79 4.8it/s 16.5s
                  all       5000      10000      0.465      0.566      0.505      0.156

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
       4/10     0.219G      1.109     0.8754     0.8585         31         64: 100%
──────────────────── 313/313 9.8it/s 31.9s
                Class     Images  Instances      Box(P          R      mAP50  mAP50-95): 100%
──────────────────── 79/79 4.6it/s 17.3s
                  all       5000      10000      0.421      0.563       0.45       0.12

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
       5/10     0.236G      1.052     0.7922     0.8509         32         64: 100%
──────────────────── 313/313 9.5it/s 32.9s
                Class     Images  Instances      Box(P          R      mAP50  mAP50-95): 100%
──────────────────── 79/79 4.9it/s 16.2s
                  all       5000      10000      0.607      0.699       0.69      0.271

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
       6/10     0.254G      1.017     0.7425     0.8462         32         64: 100%
──────────────────── 313/313 9.4it/s 33.3s
                Class     Images  Instances      Box(P          R      mAP50  mAP50-95): 100%
──────────────────── 79/79 4.8it/s 16.4s
                  all       5000      10000      0.696      0.728      0.777      0.379

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
       7/10     0.271G     0.9866     0.7047     0.8411         32         64: 100%
──────────────────── 313/313 9.6it/s 32.7s
                Class     Images  Instances      Box(P          R      mAP50  mAP50-95): 100%
──────────────────── 79/79 4.8it/s 16.4s
                  all       5000      10000      0.611      0.663      0.694      0.261

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
       8/10     0.287G     0.9525     0.6652     0.8351         32         64: 100%
──────────────────── 313/313 9.5it/s 32.9s
                Class     Images  Instances      Box(P          R      mAP50  mAP50-95): 100%
──────────────────── 79/79 4.9it/s 16.2s
                  all       5000      10000      0.684      0.702      0.764      0.357

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
       9/10     0.305G      0.935     0.6482     0.8342         32         64: 100%
──────────────────── 313/313 9.4it/s 33.4s
                Class     Images  Instances      Box(P          R      mAP50  mAP50-95): 100%
──────────────────── 79/79 5.0it/s 15.9s
```

```
                 all       5000      10000      0.626      0.675      0.714      0.272

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
      10/10     0.322G     0.9003     0.6147     0.8296         32         64: 100%
━━━━━━━━━━━━━━━━━━━━ 313/313 9.7it/s 32.3s
                 Class     Images  Instances      Box(P          R      mAP50  mAP50-95): 100%
━━━━━━━━━━━━━━━━━━━━ 79/79 5.0it/s 15.9s
                 all       5000      10000      0.628      0.679      0.715       0.27

10 epochs completed in 0.142 hours.
Optimizer stripped from /content/mnistdd_runs/yolo_train/weights/last.pt, 6.2MB
Optimizer stripped from /content/mnistdd_runs/yolo_train/weights/best.pt, 6.2MB

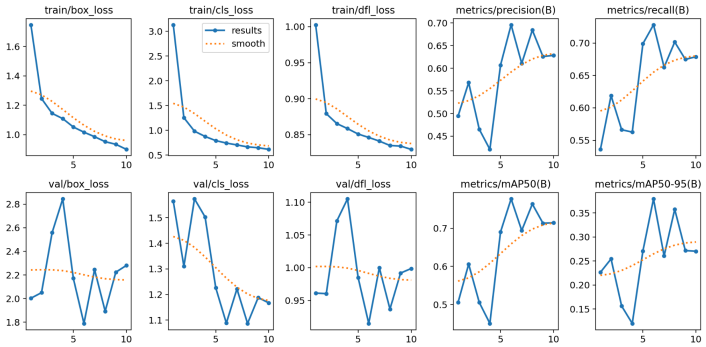
Validating /content/mnistdd_runs/yolo_train/weights/best.pt...
Ultralytics 8.3.221 🚀 Python-3.12.12 torch-2.8.0+cu126 CUDA:0 (Tesla T4, 15095MiB)
Model summary (fused): 72 layers, 3,007,598 parameters, 0 gradients, 8.1 GFLOPs
                 Class     Images  Instances      Box(P          R      mAP50  mAP50-95): 100%
━━━━━━━━━━━━━━━━━━━━ 79/79 3.9it/s 20.0s
                 all       5000      10000      0.696      0.728      0.778       0.38
                   0        946        996      0.631      0.919      0.888      0.471
                   1        928        985      0.627      0.581      0.579      0.214
                   2        943        989      0.654      0.739      0.767      0.382
                   3        953       1010      0.702      0.795      0.831      0.481
                   4        983       1034       0.66      0.673      0.716      0.315
                   5        980       1026      0.716      0.717      0.781      0.381
                   6        900        941      0.735       0.68      0.781      0.396
                   7        916        966      0.693      0.861      0.861       0.43
                   8        988       1040       0.68      0.686      0.748      0.346
                   9        956       1013      0.864      0.632      0.826      0.385
Speed: 0.0ms preprocess, 0.3ms inference, 0.0ms loss, 1.2ms postprocess per image
Results saved to /content/mnistdd_runs/yolo_train

Training completed!
```

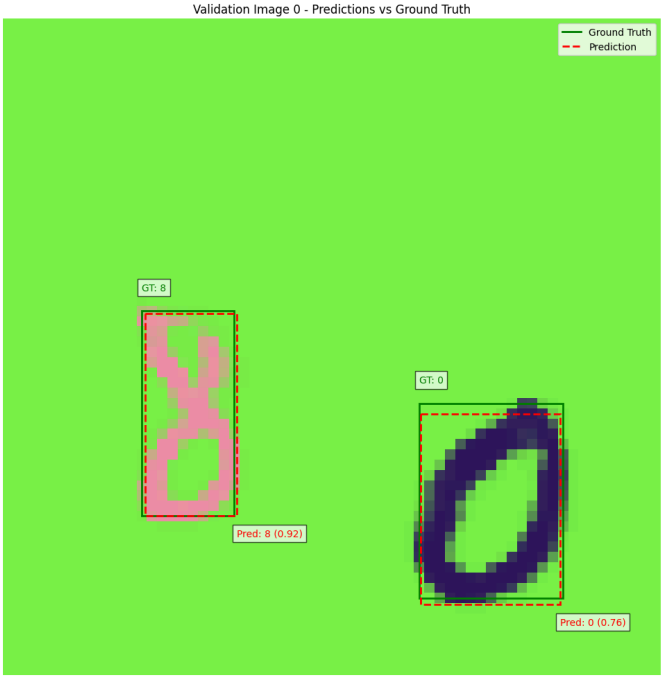
Evaluation

```
Evaluating on 5000 validation samples...
100%|██████████| 5000/5000 [00:38<00:00, 129.51it/s]
Evaluation Results:
  Average IoU: 0.7807
```

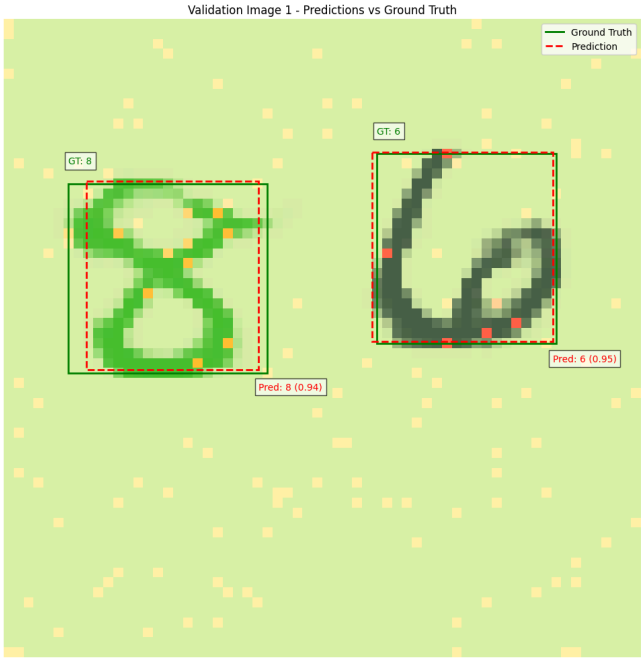
```
================================================================================
- Model trained for 10 epochs
- Average IoU on validation set: 0.7807
================================================================================
```



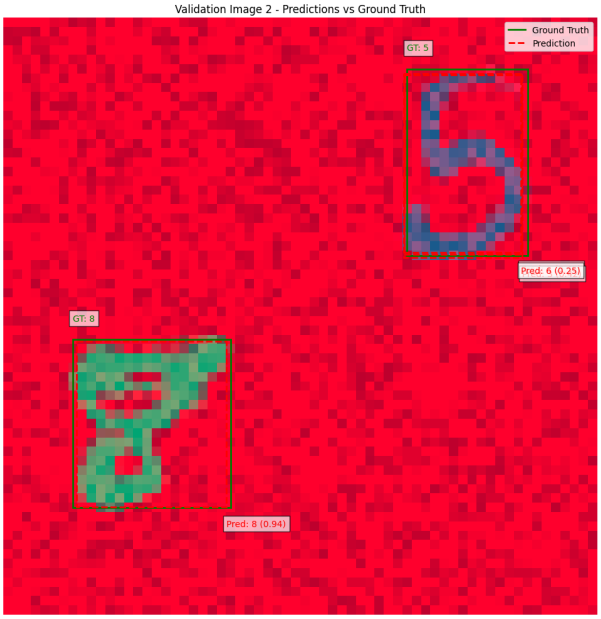
Visualization

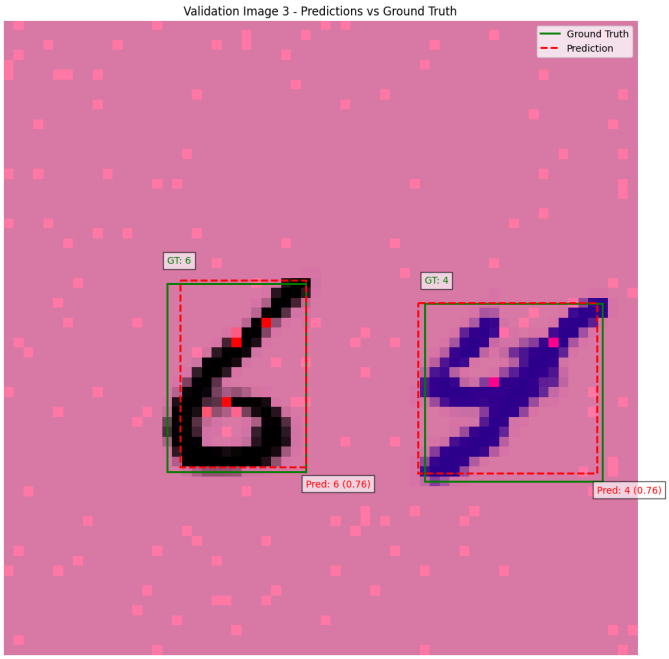


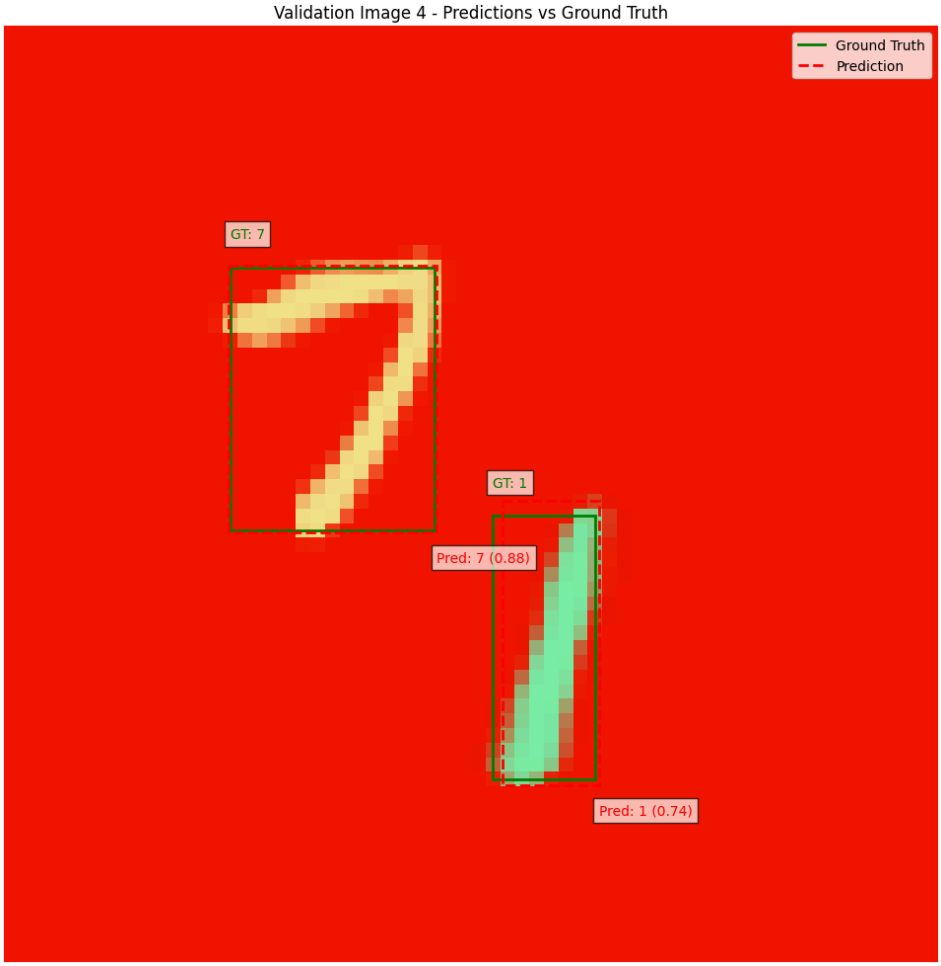
Validation Image 1 - Predictions vs Ground Truth



Validation Image 2 - Predictions vs Ground Truth




Validation Image 3 - Predictions vs Ground Truth
Ground Truth
Prediction
GT: 6
GT: 4
Pred: 6 (0.76)
Pred: 4 (0.76)


Validation Image 4 - Predictions vs Ground Truth
Ground Truth
Prediction
GT: 7
GT: 1
Pred: 7 (0.88)
Pred: 1 (0.74)

PART B

Preparing dataset

```
Preparing train set...
100%|██████████| 55000/55000 [00:23<00:00, 2378.83it/s]
Saved 55000 images and labels to /content/mnistdd_yolo/train
Preparing val set...
100%|██████████| 5000/5000 [00:02<00:00, 2192.31it/s]
Saved 5000 images and labels to /content/mnistdd_yolo/val

Dataset preparation complete!
Train images: 55000 files
Train labels: 55000 files
Val images: 5000 files
Val labels: 5000 files

Dataset configuration saved to /content/mnistdd_yolo/dataPartB.yaml
```

Training

```
Downloading https://github.com/ultralytics/assets/releases/download/v8.3.0/yolov8n.pt to 'yolov8n.pt':
100% ━━━━━━━━━━━━━━━━━━━━ 6.2MB 98.2MB/s 0.1s

Training on full dataset with optimized hyperparameters...
Configuration:
  - Model: YOLOv8 nano
  - Image size: 64x64
  - Epochs: 50 (with early stopping)
  - Batch size: 64
  - Learning rate: 0.01 (default)

Starting training...
Ultralytics 8.3.221 🚀 Python-3.12.12 torch-2.8.0+cu126 CUDA:0 (Tesla T4, 15095MiB)
engine/trainer: agnostic_nms=False, amp=True, augment=False, auto_augment=randaugment, batch=64,
bgr=0.0, box=7.5, cache=False, cfg=None, classes=None, close_mosaic=10, cls=0.5, compile=False,
conf=0.25, copy_paste=0.0, copy_paste_mode=flip, cos_lr=False, cutmix=0.0,
data=/content/mnistdd_yolo/dataPartB.yaml, degrees=0.0, deterministic=True, device=0, dfl=1.5,
dnn=False, dropout=0.0, dynamic=False, embed=None, epochs=50, erasing=0.4, exist_ok=True, fliplr=0.5,
flipud=0.0, format=torchscript, fraction=1.0, freeze=None, half=False, hsv_h=0.015, hsv_s=0.7,
hsv_v=0.4, imgsz=64, int8=False, iou=0.45, keras=False, kobj=1.0, line_width=None, lr0=0.01, lrf=0.01,
mask_ratio=4, max_det=300, mixup=0.0, mode=train, model=yolov8n.pt, momentum=0.937, mosaic=1.0,
multi_scale=False, name=yolo_full_train, nbs=64, nms=False, opset=None, optimize=False, optimizer=auto,
overlap_mask=True, patience=10, perspective=0.0, plots=True, pose=12.0, pretrained=True, profile=False,
project=mnistdd_runs, rect=False, resume=False, retina_masks=False, save=True, save_conf=False,
save_crop=False, save_dir=/content/mnistdd_runs/yolo_full_train, save_frames=False, save_json=False,
save_period=-1, save_txt=False, scale=0.5, seed=0, shear=0.0, show=False, show_boxes=True,
show_conf=True, show_labels=True, simplify=True, single_cls=False, source=None, split=val,
stream_buffer=False, task=detect, time=None, tracker=botsort.yaml, translate=0.1, val=True,
verbose=True, vid_stride=1, visualize=False, warmup_bias_lr=0.1, warmup_epochs=3, warmup_momentum=0.8,
weight_decay=0.0005, workers=8, workspace=None
Downloading https://ultralytics.com/assets/Arial.ttf to '/root/.config/Ultralytics/Arial.ttf': 100%
```

```
━━━━━━━━━━━━━━━━━━━━ 755.1KB 21.4MB/s 0.0s
Overriding model.yaml nc=80 with nc=10

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 10                  -1  1         0  torch.nn.modules.upsampling.Upsample         [None, 2, 'nearest']
 11             [-1, 6]  1         0  ultralytics.nn.modules.conv.Concat           [1]
 12                  -1  1    148224  ultralytics.nn.modules.block.C2f             [384, 128, 1]
 13                  -1  1         0  torch.nn.modules.upsampling.Upsample         [None, 2, 'nearest']
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 17            [-1, 12]  1         0  ultralytics.nn.modules.conv.Concat           [1]
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Downloading https://github.com/ultralytics/assets/releases/download/v8.3.0/yolo11n.pt to 'yolo11n.pt':
100% ━━━━━━━━━━━━━━━━━━━━ 5.4MB 103.7MB/s 0.1s
AMP: checks passed ✅
train: Fast image access ✅ (ping: 0.0±0.0 ms, read: 28.1±24.2 MB/s, size: 1.2 KB)
train: Scanning /content/mnistdd_yolo/train/labels... 55000 images, 0 backgrounds, 0 corrupt: 100%
━━━━━━━━━━━━━━━━━━━━ 55000/55000 2.3Kit/s 24.3s
train: New cache created: /content/mnistdd_yolo/train/labels.cache
albumentations: Blur(p=0.01, blur_limit=(3, 7)), MedianBlur(p=0.01, blur_limit=(3, 7)), ToGray(p=0.01,
method='weighted_average', num_output_channels=3), CLAHE(p=0.01, clip_limit=(1.0, 4.0),
tile_grid_size=(8, 8))
val: Fast image access ✅ (ping: 0.0±0.0 ms, read: 44.7±23.1 MB/s, size: 1.3 KB)
val: Scanning /content/mnistdd_yolo/val/labels... 5000 images, 0 backgrounds, 0 corrupt: 100%
━━━━━━━━━━━━━━━━━━━━ 5000/5000 1.8Kit/s 2.7s
val: New cache created: /content/mnistdd_yolo/val/labels.cache
Plotting labels to /content/mnistdd_runs/yolo_full_train/labels.jpg...
optimizer: 'optimizer=auto' found, ignoring 'lr0=0.01' and 'momentum=0.937' and determining best
'optimizer', 'lr0' and 'momentum' automatically...
optimizer: SGD(lr=0.01, momentum=0.9) with parameter groups 57 weight(decay=0.0), 64
weight(decay=0.0005), 63 bias(decay=0.0)
Image sizes 64 train, 64 val
Using 2 dataloader workers
Logging results to /content/mnistdd_runs/yolo_full_train
Starting training for 50 epochs...

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
       1/50     0.168G      1.832      2.849     0.9899         68         64: 100%
━━━━━━━━━━━━━━━━━━━━ 860/860 6.0it/s 2:23
```

```
               Class     Images  Instances      Box(P          R      mAP50  mAP50-95): 100%
━━━━━━━━━━━━━━━━━━━━ 40/40 2.7it/s 15.1s
                 all       5000      10000       0.67      0.658      0.683       0.45

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
       2/50     0.211G      1.492        1.3     0.9089         75         64: 100%
━━━━━━━━━━━━━━━━━━━━ 860/860 6.2it/s 2:20
               Class     Images  Instances      Box(P          R      mAP50  mAP50-95): 100%
━━━━━━━━━━━━━━━━━━━━ 40/40 2.9it/s 13.7s
                 all       5000      10000       0.89      0.774      0.857      0.607

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
       3/50     0.223G      1.459      1.153     0.9033         78         64: 100%
━━━━━━━━━━━━━━━━━━━━ 860/860 6.2it/s 2:19
               Class     Images  Instances      Box(P          R      mAP50  mAP50-95): 100%
━━━━━━━━━━━━━━━━━━━━ 40/40 2.8it/s 14.3s
                 all       5000      10000      0.845      0.785      0.865      0.579

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
       4/50     0.234G      1.376      1.036     0.8924         80         64: 100%
━━━━━━━━━━━━━━━━━━━━ 860/860 6.2it/s 2:18
               Class     Images  Instances      Box(P          R      mAP50  mAP50-95): 100%
━━━━━━━━━━━━━━━━━━━━ 40/40 2.7it/s 14.6s
                 all       5000      10000      0.941      0.886       0.94      0.701

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
       5/50     0.246G      1.265     0.9233     0.8796         65         64: 100%
━━━━━━━━━━━━━━━━━━━━ 860/860 6.3it/s 2:18
               Class     Images  Instances      Box(P          R      mAP50  mAP50-95): 100%
━━━━━━━━━━━━━━━━━━━━ 40/40 2.7it/s 14.6s
                 all       5000      10000      0.947      0.886      0.944       0.73

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
       6/50     0.258G       1.21      0.862     0.8718         79         64: 100%
━━━━━━━━━━━━━━━━━━━━ 860/860 6.3it/s 2:17
               Class     Images  Instances      Box(P          R      mAP50  mAP50-95): 100%
━━━━━━━━━━━━━━━━━━━━ 40/40 2.7it/s 15.0s
                 all       5000      10000      0.938      0.921      0.954      0.749

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
       7/50     0.268G      1.174     0.8239     0.8688         94         64: 100%
━━━━━━━━━━━━━━━━━━━━ 860/860 6.2it/s 2:18
               Class     Images  Instances      Box(P          R      mAP50  mAP50-95): 100%
━━━━━━━━━━━━━━━━━━━━ 40/40 2.7it/s 14.8s
                 all       5000      10000      0.962      0.907      0.956      0.764

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
       8/50     0.279G      1.148     0.7973     0.8647         72         64: 100%
━━━━━━━━━━━━━━━━━━━━ 860/860 6.0it/s 2:23
               Class     Images  Instances      Box(P          R      mAP50  mAP50-95): 100%
━━━━━━━━━━━━━━━━━━━━ 40/40 2.8it/s 14.3s
                 all       5000      10000      0.964       0.92      0.961      0.777

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
       9/50     0.291G      1.124     0.7735     0.8615         70         64: 100%
━━━━━━━━━━━━━━━━━━━━ 860/860 6.2it/s 2:18
               Class     Images  Instances      Box(P          R      mAP50  mAP50-95): 100%
━━━━━━━━━━━━━━━━━━━━ 40/40 2.8it/s 14.2s
                 all       5000      10000      0.965      0.924      0.964      0.781
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      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
      10/50     0.303G      1.108     0.7587     0.8609         70         64: 100%
━━━━━━━━━━━━━━━━━━━━ 860/860 6.1it/s 2:21
                 Class     Images  Instances      Box(P          R      mAP50  mAP50-95): 100%
━━━━━━━━━━━━━━━━━━━━ 40/40 2.8it/s 14.2s
                   all       5000      10000      0.955      0.938      0.966      0.788

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
      11/50     0.314G      1.091     0.7424     0.8589         71         64: 100%
━━━━━━━━━━━━━━━━━━━━ 860/860 6.3it/s 2:17
                 Class     Images  Instances      Box(P          R      mAP50  mAP50-95): 100%
━━━━━━━━━━━━━━━━━━━━ 40/40 2.8it/s 14.1s
                   all       5000      10000      0.969      0.931      0.967      0.793

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
      12/50     0.326G      1.077     0.7301     0.8581         70         64: 100%
━━━━━━━━━━━━━━━━━━━━ 860/860 6.3it/s 2:16
                 Class     Images  Instances      Box(P          R      mAP50  mAP50-95): 100%
━━━━━━━━━━━━━━━━━━━━ 40/40 2.9it/s 14.0s
                   all       5000      10000      0.976      0.927      0.967      0.798

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
      13/50     0.336G      1.068     0.7181     0.8558         63         64: 100%
━━━━━━━━━━━━━━━━━━━━ 860/860 6.4it/s 2:14
                 Class     Images  Instances      Box(P          R      mAP50  mAP50-95): 100%
━━━━━━━━━━━━━━━━━━━━ 40/40 2.7it/s 14.6s
                   all       5000      10000      0.968      0.939       0.97        0.8

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
      14/50     0.348G      1.056     0.7073     0.8545         58         64: 100%
━━━━━━━━━━━━━━━━━━━━ 860/860 6.3it/s 2:17
                 Class     Images  Instances      Box(P          R      mAP50  mAP50-95): 100%
━━━━━━━━━━━━━━━━━━━━ 40/40 2.8it/s 14.2s
                   all       5000      10000      0.972      0.938       0.97      0.803

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
      15/50     0.359G      1.046     0.6998     0.8541         76         64: 100%
━━━━━━━━━━━━━━━━━━━━ 860/860 6.3it/s 2:16
                 Class     Images  Instances      Box(P          R      mAP50  mAP50-95): 100%
━━━━━━━━━━━━━━━━━━━━ 40/40 2.8it/s 14.3s
                   all       5000      10000      0.973      0.935       0.97      0.805

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
      16/50     0.371G       1.04     0.6902     0.8532         88         64: 100%
━━━━━━━━━━━━━━━━━━━━ 860/860 6.2it/s 2:19
                 Class     Images  Instances      Box(P          R      mAP50  mAP50-95): 100%
━━━━━━━━━━━━━━━━━━━━ 40/40 2.8it/s 14.4s
                   all       5000      10000      0.969      0.942      0.971      0.808

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
      17/50     0.383G      1.033     0.6862     0.8523         77         64: 100%
━━━━━━━━━━━━━━━━━━━━ 860/860 6.1it/s 2:21
                 Class     Images  Instances      Box(P          R      mAP50  mAP50-95): 100%
━━━━━━━━━━━━━━━━━━━━ 40/40 2.7it/s 14.7s
                   all       5000      10000       0.97      0.942      0.972      0.809

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
      18/50     0.395G      1.023     0.6779     0.8522         68         64: 100%
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──────────────────── 860/860 6.2it/s 2:19
               Class     Images  Instances      Box(P          R      mAP50  mAP50-95): 100%
──────────────────── 40/40 2.8it/s 14.3s
                 all       5000      10000      0.975      0.937      0.972       0.81

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
      19/50     0.404G      1.018      0.673     0.8514         92         64: 100%
──────────────────── 860/860 6.3it/s 2:17
               Class     Images  Instances      Box(P          R      mAP50  mAP50-95): 100%
──────────────────── 40/40 2.8it/s 14.4s
                 all       5000      10000      0.974       0.94      0.972      0.811

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
      20/50     0.416G      1.013     0.6665     0.8501         70         64: 100%
──────────────────── 860/860 6.2it/s 2:18
               Class     Images  Instances      Box(P          R      mAP50  mAP50-95): 100%
──────────────────── 40/40 2.8it/s 14.2s
                 all       5000      10000      0.976       0.94      0.973      0.813

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
      21/50     0.428G      1.006     0.6607     0.8499         84         64: 100%
──────────────────── 860/860 6.3it/s 2:17
               Class     Images  Instances      Box(P          R      mAP50  mAP50-95): 100%
──────────────────── 40/40 2.7it/s 14.6s
                 all       5000      10000      0.975       0.94      0.973      0.813

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
      22/50     0.439G          1     0.6563     0.8502         94         64: 100%
──────────────────── 860/860 6.2it/s 2:18
               Class     Images  Instances      Box(P          R      mAP50  mAP50-95): 100%
──────────────────── 40/40 2.8it/s 14.5s
                 all       5000      10000      0.973      0.944      0.973      0.814

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
      23/50     0.451G     0.9943       0.65     0.8492         83         64: 100%
──────────────────── 860/860 6.2it/s 2:19
               Class     Images  Instances      Box(P          R      mAP50  mAP50-95): 100%
──────────────────── 40/40 2.7it/s 14.6s
                 all       5000      10000      0.973      0.944      0.973      0.815

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
      24/50     0.463G     0.9878     0.6454     0.8485         68         64: 100%
──────────────────── 860/860 6.2it/s 2:20
               Class     Images  Instances      Box(P          R      mAP50  mAP50-95): 100%
──────────────────── 40/40 2.8it/s 14.5s
                 all       5000      10000      0.974      0.944      0.973      0.815

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
      25/50     0.473G     0.9828     0.6391     0.8477         79         64: 100%
──────────────────── 860/860 6.2it/s 2:19
               Class     Images  Instances      Box(P          R      mAP50  mAP50-95): 100%
──────────────────── 40/40 2.8it/s 14.2s
                 all       5000      10000      0.974      0.944      0.974      0.816

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
      26/50     0.484G     0.9768     0.6362     0.8477         79         64: 100%
──────────────────── 860/860 6.2it/s 2:18
               Class     Images  Instances      Box(P          R      mAP50  mAP50-95): 100%
──────────────────── 40/40 2.8it/s 14.5s
```

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                 all       5000      10000      0.975      0.944      0.974      0.816

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
      27/50     0.496G     0.9717     0.6318     0.8468         94         64: 100%
━━━━━━━━━━━━━━━━━━━━ 860/860 6.2it/s 2:19
                 Class     Images  Instances      Box(P          R      mAP50  mAP50-95): 100%
━━━━━━━━━━━━━━━━━━━━ 40/40 2.8it/s 14.2s
                 all       5000      10000      0.976      0.943      0.974      0.817

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
      28/50     0.508G     0.9663     0.6243     0.8462         68         64: 100%
━━━━━━━━━━━━━━━━━━━━ 860/860 6.2it/s 2:18
                 Class     Images  Instances      Box(P          R      mAP50  mAP50-95): 100%
━━━━━━━━━━━━━━━━━━━━ 40/40 2.8it/s 14.2s
                 all       5000      10000      0.975      0.944      0.974      0.817

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
      29/50      0.52G     0.9601     0.6224     0.8451         95         64: 100%
━━━━━━━━━━━━━━━━━━━━ 860/860 6.4it/s 2:15
                 Class     Images  Instances      Box(P          R      mAP50  mAP50-95): 100%
━━━━━━━━━━━━━━━━━━━━ 40/40 2.8it/s 14.5s
                 all       5000      10000      0.974      0.946      0.974      0.818

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
      30/50     0.529G     0.9571     0.6171     0.8458         81         64: 100%
━━━━━━━━━━━━━━━━━━━━ 860/860 6.4it/s 2:14
                 Class     Images  Instances      Box(P          R      mAP50  mAP50-95): 100%
━━━━━━━━━━━━━━━━━━━━ 40/40 2.8it/s 14.1s
                 all       5000      10000      0.974      0.946      0.975      0.819

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
      31/50     0.541G     0.9503     0.6108     0.8449         80         64: 100%
━━━━━━━━━━━━━━━━━━━━ 860/860 6.2it/s 2:18
                 Class     Images  Instances      Box(P          R      mAP50  mAP50-95): 100%
━━━━━━━━━━━━━━━━━━━━ 40/40 2.8it/s 14.4s
                 all       5000      10000      0.974      0.947      0.974       0.82

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
      32/50     0.553G     0.9471     0.6094     0.8448         91         64: 100%
━━━━━━━━━━━━━━━━━━━━ 860/860 6.2it/s 2:19
                 Class     Images  Instances      Box(P          R      mAP50  mAP50-95): 100%
━━━━━━━━━━━━━━━━━━━━ 40/40 2.8it/s 14.4s
                 all       5000      10000      0.975      0.947      0.974       0.82

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
      33/50     0.564G       0.94     0.6027     0.8433         75         64: 100%
━━━━━━━━━━━━━━━━━━━━ 860/860 6.2it/s 2:19
                 Class     Images  Instances      Box(P          R      mAP50  mAP50-95): 100%
━━━━━━━━━━━━━━━━━━━━ 40/40 2.8it/s 14.5s
                 all       5000      10000      0.977      0.946      0.975       0.82

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
      34/50     0.576G      0.935     0.6002     0.8433         80         64: 100%
━━━━━━━━━━━━━━━━━━━━ 860/860 6.2it/s 2:20
                 Class     Images  Instances      Box(P          R      mAP50  mAP50-95): 100%
━━━━━━━━━━━━━━━━━━━━ 40/40 2.7it/s 14.6s
                 all       5000      10000      0.978      0.945      0.975      0.821

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
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      35/50     0.588G     0.9341     0.5967     0.8422         92         64: 100%
━━━━━━━━━━━━━━━━━━━━ 860/860 6.2it/s 2:19
                 Class     Images  Instances      Box(P          R      mAP50  mAP50-95): 100%
━━━━━━━━━━━━━━━━━━━━ 40/40 2.7it/s 14.9s
                   all       5000      10000      0.977      0.946      0.975      0.821

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
      36/50     0.598G     0.9259     0.5933     0.8426         82         64: 100%
━━━━━━━━━━━━━━━━━━━━ 860/860 6.1it/s 2:21
                 Class     Images  Instances      Box(P          R      mAP50  mAP50-95): 100%
━━━━━━━━━━━━━━━━━━━━ 40/40 2.8it/s 14.5s
                   all       5000      10000      0.976      0.946      0.975      0.821

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
      37/50     0.609G     0.9236       0.59     0.8418         67         64: 100%
━━━━━━━━━━━━━━━━━━━━ 860/860 6.1it/s 2:20
                 Class     Images  Instances      Box(P          R      mAP50  mAP50-95): 100%
━━━━━━━━━━━━━━━━━━━━ 40/40 2.8it/s 14.5s
                   all       5000      10000      0.976      0.947      0.975      0.822

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
      38/50     0.621G     0.9165     0.5832     0.8414         79         64: 100%
━━━━━━━━━━━━━━━━━━━━ 860/860 6.1it/s 2:21
                 Class     Images  Instances      Box(P          R      mAP50  mAP50-95): 100%
━━━━━━━━━━━━━━━━━━━━ 40/40 2.7it/s 14.8s
                   all       5000      10000      0.976      0.947      0.975      0.822

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
      39/50     0.633G     0.9095     0.5769      0.841         56         64: 100%
━━━━━━━━━━━━━━━━━━━━ 860/860 6.0it/s 2:23
                 Class     Images  Instances      Box(P          R      mAP50  mAP50-95): 100%
━━━━━━━━━━━━━━━━━━━━ 40/40 2.7it/s 14.8s
                   all       5000      10000      0.976      0.948      0.975      0.823

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
      40/50     0.645G     0.9033     0.5734     0.8407         72         64: 100%
━━━━━━━━━━━━━━━━━━━━ 860/860 6.2it/s 2:19
                 Class     Images  Instances      Box(P          R      mAP50  mAP50-95): 100%
━━━━━━━━━━━━━━━━━━━━ 40/40 2.8it/s 14.2s
                   all       5000      10000      0.976      0.948      0.975      0.823
Closing dataloader mosaic
albumentations: Blur(p=0.01, blur_limit=(3, 7)), MedianBlur(p=0.01, blur_limit=(3, 7)), ToGray(p=0.01,
method='weighted_average', num_output_channels=3), CLAHE(p=0.01, clip_limit=(1.0, 4.0),
tile_grid_size=(8, 8))

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
      41/50     0.654G      0.767     0.4301      0.814         48         64: 100%
━━━━━━━━━━━━━━━━━━━━ 860/860 6.8it/s 2:07
                 Class     Images  Instances      Box(P          R      mAP50  mAP50-95): 100%
━━━━━━━━━━━━━━━━━━━━ 40/40 2.7it/s 14.7s
                   all       5000      10000      0.977      0.947      0.976      0.824

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
      42/50     0.666G     0.7535     0.4187     0.8123         48         64: 100%
━━━━━━━━━━━━━━━━━━━━ 860/860 6.8it/s 2:07
                 Class     Images  Instances      Box(P          R      mAP50  mAP50-95): 100%
━━━━━━━━━━━━━━━━━━━━ 40/40 2.8it/s 14.4s
                   all       5000      10000      0.977      0.949      0.976      0.824
```

```
      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
      43/50     0.678G     0.7447     0.4126     0.8109         48         64: 100%
━━━━━━━━━━━━━━━━━━━━ 860/860 6.9it/s 2:05
                 Class     Images  Instances      Box(P          R      mAP50  mAP50-95): 100%
━━━━━━━━━━━━━━━━━━━━ 40/40 2.8it/s 14.4s
                   all       5000      10000      0.976      0.949      0.976      0.825

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
      44/50     0.689G     0.7379     0.4065     0.8111         48         64: 100%
━━━━━━━━━━━━━━━━━━━━ 860/860 6.9it/s 2:05
                 Class     Images  Instances      Box(P          R      mAP50  mAP50-95): 100%
━━━━━━━━━━━━━━━━━━━━ 40/40 2.8it/s 14.4s
                   all       5000      10000      0.977      0.949      0.976      0.826

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
      45/50     0.701G       0.73     0.4008     0.8094         48         64: 100%
━━━━━━━━━━━━━━━━━━━━ 860/860 6.9it/s 2:05
                 Class     Images  Instances      Box(P          R      mAP50  mAP50-95): 100%
━━━━━━━━━━━━━━━━━━━━ 40/40 2.8it/s 14.3s
                   all       5000      10000      0.977       0.95      0.976      0.826

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
      46/50     0.713G      0.726     0.3969     0.8091         48         64: 100%
━━━━━━━━━━━━━━━━━━━━ 860/860 6.9it/s 2:04
                 Class     Images  Instances      Box(P          R      mAP50  mAP50-95): 100%
━━━━━━━━━━━━━━━━━━━━ 40/40 2.8it/s 14.5s
                   all       5000      10000      0.977       0.95      0.976      0.827

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
      47/50     0.723G     0.7194      0.392     0.8078         48         64: 100%
━━━━━━━━━━━━━━━━━━━━ 860/860 6.8it/s 2:06
                 Class     Images  Instances      Box(P          R      mAP50  mAP50-95): 100%
━━━━━━━━━━━━━━━━━━━━ 40/40 2.8it/s 14.4s
                   all       5000      10000      0.978       0.95      0.977      0.827

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
      48/50     0.734G     0.7149     0.3885      0.808         47         64: 100%
━━━━━━━━━━━━━━━━━━━━ 860/860 6.8it/s 2:06
                 Class     Images  Instances      Box(P          R      mAP50  mAP50-95): 100%
━━━━━━━━━━━━━━━━━━━━ 40/40 2.7it/s 14.8s
                   all       5000      10000      0.973      0.954      0.977      0.828

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
      49/50     0.746G     0.7089     0.3837     0.8075         48         64: 100%
━━━━━━━━━━━━━━━━━━━━ 860/860 6.9it/s 2:05
                 Class     Images  Instances      Box(P          R      mAP50  mAP50-95): 100%
━━━━━━━━━━━━━━━━━━━━ 40/40 2.7it/s 14.6s
                   all       5000      10000      0.969      0.959      0.977      0.828

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
      50/50     0.758G     0.7016     0.3773     0.8067         48         64: 100%
━━━━━━━━━━━━━━━━━━━━ 860/860 6.9it/s 2:06
                 Class     Images  Instances      Box(P          R      mAP50  mAP50-95): 100%
━━━━━━━━━━━━━━━━━━━━ 40/40 2.8it/s 14.3s
                   all       5000      10000      0.968      0.959      0.977      0.828

50 epochs completed in 2.093 hours.
Optimizer stripped from /content/mnistdd_runs/yolo_full_train/weights/last.pt, 6.2MB
Optimizer stripped from /content/mnistdd_runs/yolo_full_train/weights/best.pt, 6.2MB
```

```
Validating /content/mnistdd_runs/yolo_full_train/weights/best.pt...
Ultralytics 8.3.221 🚀 Python-3.12.12 torch-2.8.0+cu126 CUDA:0 (Tesla T4, 15095MiB)
Model summary (fused): 72 layers, 3,007,598 parameters, 0 gradients, 8.1 GFLOPs
                 Class     Images  Instances      Box(P          R      mAP50  mAP50-95): 100%
                   ━━━━━━━━━━━━━━ 40/40 2.2it/s 18.2s
                   all       5000      10000      0.969      0.959      0.977      0.828
                     0        946        996      0.963      0.985      0.991      0.877
                     1        928        985      0.957      0.786      0.886      0.661
                     2        943        989       0.98      0.989      0.994      0.847
                     3        953       1010      0.965      0.976      0.987      0.848
                     4        983       1034      0.979      0.975      0.987      0.831
                     5        980       1026      0.975      0.979      0.988      0.855
                     6        900        941      0.971      0.977      0.987      0.855
                     7        916        966      0.957      0.967      0.981      0.833
                     8        988       1040      0.981      0.984      0.991      0.846
                     9        956       1013      0.959      0.972      0.984      0.827
Speed: 0.0ms preprocess, 0.1ms inference, 0.0ms loss, 1.1ms postprocess per image
Results saved to /content/mnistdd_runs/yolo_full_train

Training completed!
```

Evaluation

```
1. Running YOLO validation (mAP, precision, recall)...
Ultralytics 8.3.221 🚀 Python-3.12.12 torch-2.8.0+cu126 CUDA:0 (Tesla T4, 15095MiB)
Model summary (fused): 72 layers, 3,007,598 parameters, 0 gradients, 8.1 GFLOPs
val: Fast image access ✅ (ping: 0.0±0.0 ms, read: 98.6±48.6 MB/s, size: 1.4 KB)
val: Scanning /content/mnistdd_yolo/val/labels.cache... 5000 images, 0 backgrounds, 0
corrupt: 100% ━━━━━━━━━━━━━━━━━━━━ 5000/5000 8.8Mit/s 0.0s
                 Class     Images  Instances      Box(P          R      mAP50  mAP50-95):
100% ━━━━━━━━━━━━━━━━━━━━ 157/157 8.4it/s 18.8s
                   all       5000      10000      0.979      0.943      0.984       0.81
                     0        946        996      0.975      0.981      0.993      0.864
                     1        928        985      0.983      0.722      0.909      0.622
                     2        943        989      0.981      0.984      0.994      0.829
                     3        953       1010      0.984      0.964      0.992      0.833
                     4        983       1034      0.984      0.961      0.993      0.814
                     5        980       1026      0.976       0.97      0.992      0.841
                     6        900        941      0.983      0.968      0.993      0.841
                     7        916        966      0.972      0.952      0.991      0.821
                     8        988       1040      0.985       0.97      0.994      0.829
                     9        956       1013      0.969      0.959       0.99      0.808
Speed: 0.0ms preprocess, 0.5ms inference, 0.0ms loss, 0.8ms postprocess per image
Results saved to /content/runs/detect/val

================================================================================

- Model trained for 50 epochs

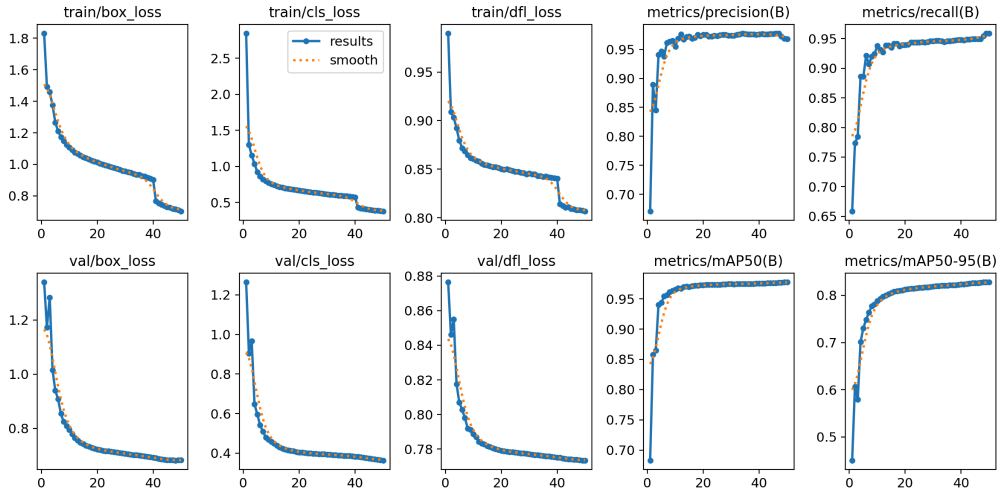
Evaluation:
```

```
   mAP@0.5: 0.9841
   mAP@0.5:0.95: 0.8102
   Precision: 0.9793
   Recall: 0.9430

================================================================================

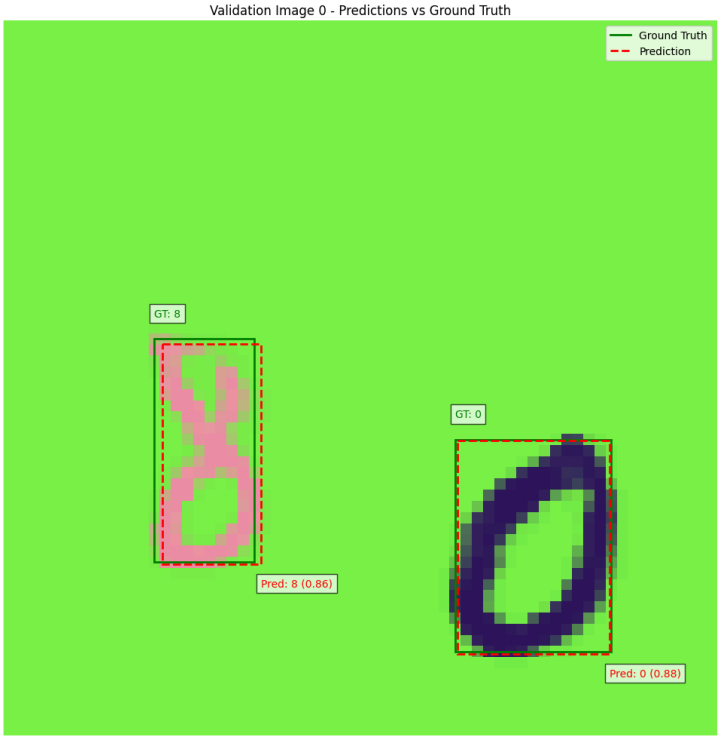
Evaluating on 5000 validation samples...
100%|████████████| 5000/5000 [00:36<00:00, 136.87it/s]

 Average IoU: 0.8644
```

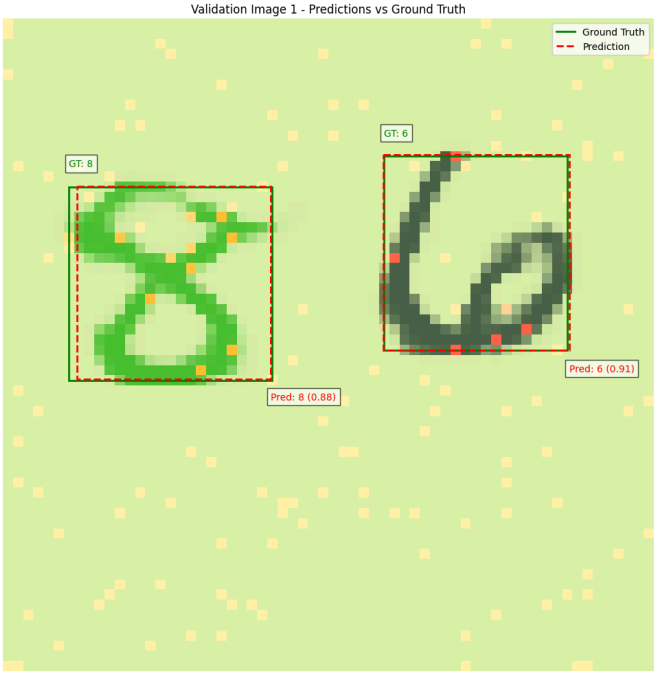


Visualization

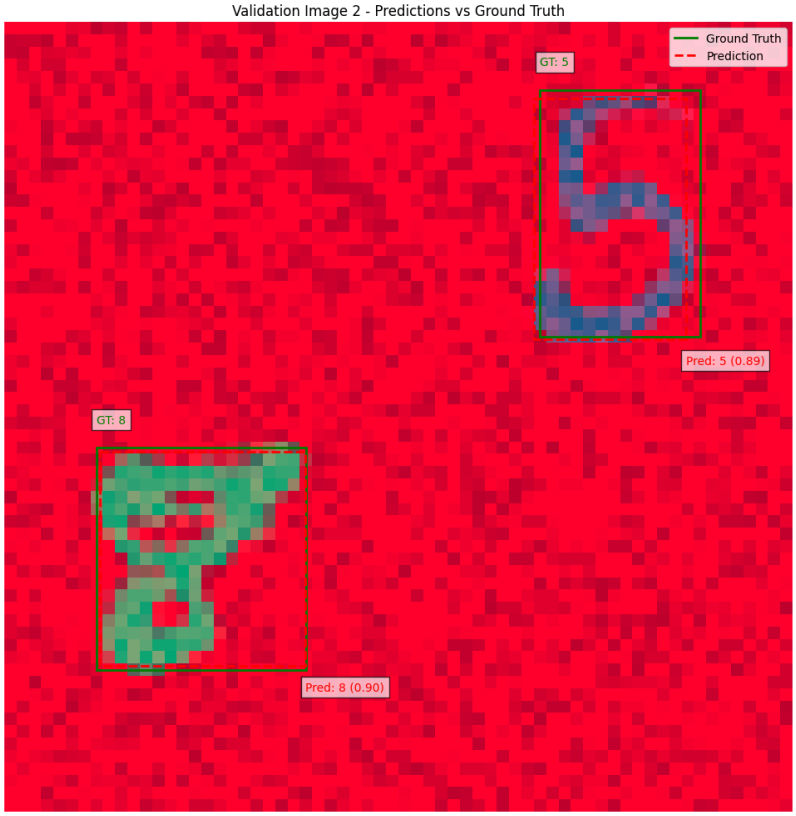
Validation Image 0 - Predictions vs Ground Truth



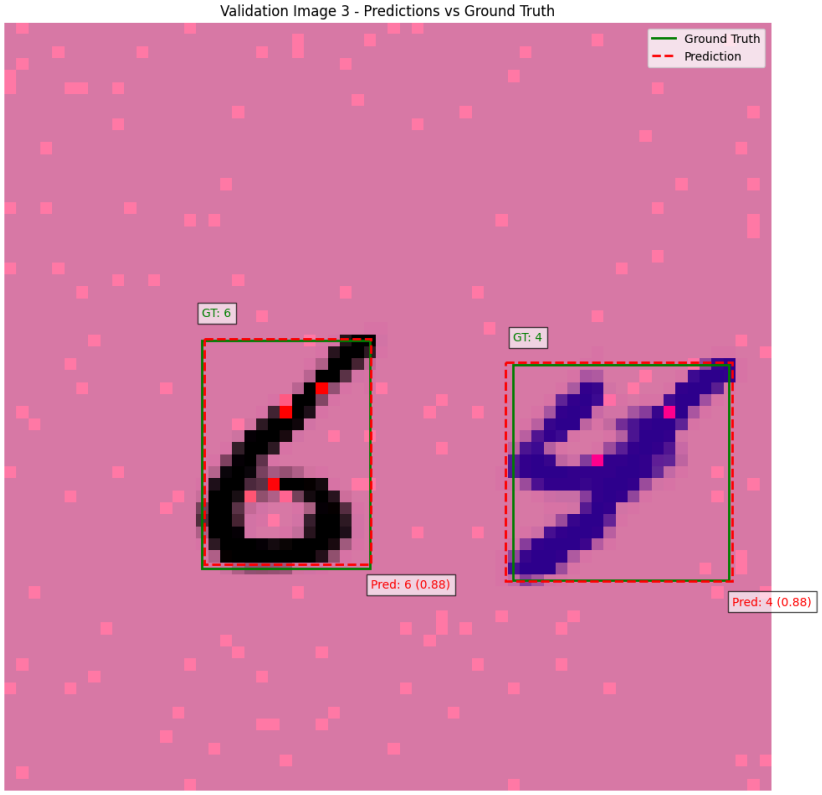
Validation Image 1 - Predictions vs Ground Truth

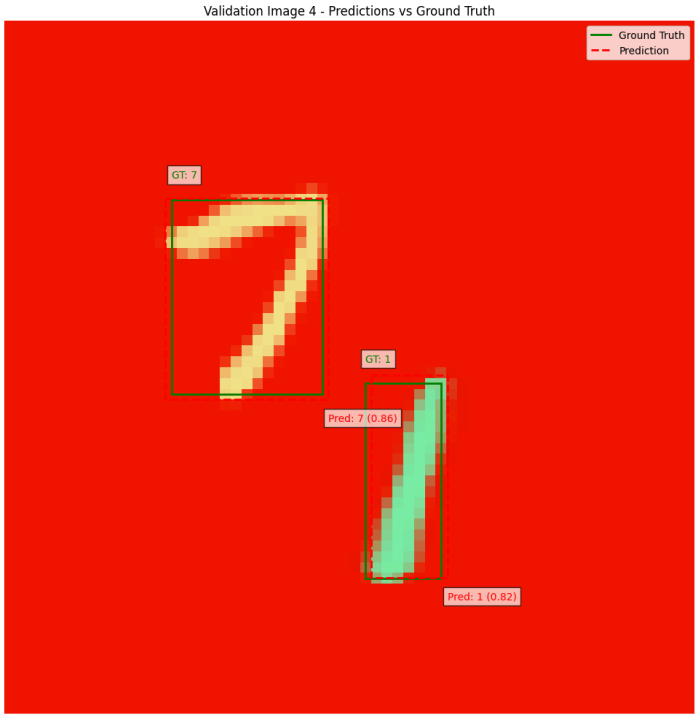


Validation Image 2 - Predictions vs Ground Truth



Validation Image 3 - Predictions vs Ground Truth




Validation Image 4 - Predictions vs Ground Truth
Ground Truth
Prediction
GT: 7
GT: 1
Pred: 7 (0.86)
Pred: 1 (0.82)